

# A Study on Reactive and Hybrid Protocols in MANET

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**Abstract**—Mobile ad hoc networks are a type of transitory networks where nodes are moving without any established infrastructure or centralized management. The terms "mobile" and "ad hoc" refer to transient networks without any fixed infrastructure. An infrastructure-less network known as a MANET is self-configurable, meaning that any node can travel in any direction and create any network architecture. Due to the high degree of mobility of the nodes in a MANET, the topology is constantly changing and the nodes are dynamically joined in any way. MANETs are used in a wide range of applications, including emergency services, battlefields, and disaster detection, they offer numerous benefits to numerous enterprises that require wireless roaming. Routing in MANETs is a challenging task that has drawn a lot of interest from researchers worldwide. Numerous routing protocols have been created to get around this problem, and the number is steadily growing. In this paper we discuss on proactive and reactive protocols in MANET. Further we discuss on the classification of proactive protocols and reactive protocols.

**Index Terms**—MANET, MOBILE NETWORK, REACTIVE, HYBRID

## I. INTRODUCTION

Ad-hoc networks are mobile wireless networks that lack a reliable infrastructure. There are no fixed routers; each node acts as a router, forwarding traffic from other nodes. Ad hoc networks were first primarily used for military applications. MANETs (Mobile Ad-hoc Networks) are a type of ad-hoc network with a rapidly changing topology [1]. These networks typically cover a large region and can connect nodes that range in number from a few to several thousand. A MANET's topology is always changing and its nodes are dynamically connected in any manner because of the high degree of mobility of its nodes. The rate of change is determined by the nodes velocity. In this kind of network, every node

forwards the desired data by acting as a host and a router. The emergence of portable computers and communication devices, including laptops, cell phones, and PDAs, is causing a fundamental change in our information society. Wireless networks are made up of many nodes that communicate with each other through a wireless channel. There are now two types of mobile wireless networks: infrastructure networks and infrastructure-less networks. Infrastructure networks allow mobile devices to connect to base stations connected to fixed network infrastructure. Every node in the infrastructure networks can be reached via a fixed access point, like a base station [2].

## II. CLASSIFICATION OF WIRELESS NETWORK

Wireless networks are classified as mentioned in following ways.

### 2.1 Infrastructure-less (Ad-hoc) wireless network

In Infrastructure less or ad hoc wireless network, the mobile node can move while communicating, there are no fixed base stations. Where each node participates in routing by forwarding data dynamically based on the network connectivity. It improves the Scalability of wireless networks compared to infrastructure based wireless networks because of its decentralized nature. In critical situations such as natural disasters, military conflicts or any emergency moment, ad-hoc networks are best suitable due to minimal configuration and quick operation.

### 2.2 Infrastructure-based wireless network

This type wireless network is pre-constructed infrastructure that is made of fixed and network nodes and delivered network services via these infrastructures. The mobile node can move while communicating, the base stations are fixed and as the node goes out of the range of a base station, it gets into the range of another base station.

### III. CHALLENGES IN MANET

The following are the factors that are applicable only to MANET, but are not limited to

#### 3.1 Dynamic Topology

The nodes are free to move and it does not require any fixed infrastructure. Due to this dynamic nature the path between the nodes are not static.

#### 3.2 Limited Bandwidth

Between communicating nodes only limited bandwidth is available than infrastructure networks. The communication is less reliable since it makes use of electromagnetic waves through air.

#### 3.3 Energy Constraints

The nodes within the network are battery operated which exhaust over time thus reducing the active duration of node. It requires techniques for energy management.

#### 3.4 Path Failures

Due to the dynamic nature of nodes, there is no static link between the nodes thus resulting in frequent link breakages leading to frequent path failures and route discoveries.

#### 3.5 Hidden Terminal Problem

It refers to collision of packets at a receiving node due to the movement of nodes; hence ongoing session suffers frequent path breaks. This situation leads to often path breaks.

### IV. ROUTING PROTOCOLS

A routing protocol is needed whenever a packet needs to be transmitted to a destination via number of nodes. There are numerous of routing protocols have been proposed for such kind of ad hoc networks. These protocols find

a route for packet delivery and deliver the packet to the correct destination. Routing protocols can be commonly classified into three types as Table Driven Protocols or Proactive Protocols, On-Demand Protocols or Reactive Protocols and Hybrid protocols [3]

#### 4.1 Table Driven or Proactive Protocols

These routing protocols require every node to maintain up -to-date information of each and every node in the network. Some of the existing table driven or proactive protocols are: DSDV, DBF, GSR, WRP and ZRP.

#### 4.2 On-Demand Protocols or Reactive Protocols

These routing protocols require a route from source to destination on demand rather maintaining frequent update.

Some of the existing on demand routing protocols are: DSR, AODV and TORA.

#### 4.3 Hybrid Routing Protocols

These routing protocols combine the features of proactive and reactive routing protocols and hence use the both.

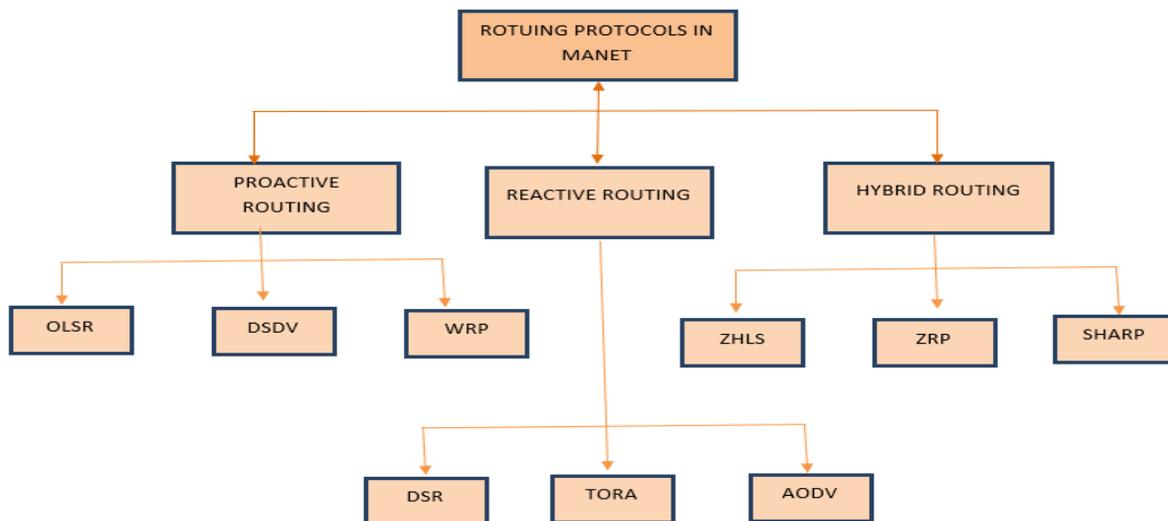


Fig 1 Classification of Routing Protocols

V PROACTIVE PROTOCOLS

Table-driven (proactive) routing systems maintain precise and consistent routing information at each network node to ensure that routes to all destinations are readily available. This approach reduces route discovery time because each node already has a routing database with the necessary paths. Maintaining such tables requires regular modifications, even in the absence of any network activity, which increases overhead. reactive (on-demand) routing protocols, In order to guarantee that routes to every destination are easily accessible, table-driven (proactive) routing systems keep accurate and consistent routing information at every node in a network. Because every node already has a routing database with the required paths, this method minimizes route discovery time. Even with little network activity, maintaining such tables necessitates frequent changes, which raises overhead.

On-demand (reactive) routing protocols, on the other hand, only create routes in response to source node requests, which lowers overhead but may result in higher latency because of the route discovery procedure. Because proactive protocols like DSDV (Destination-Sequenced Distance-Vector Routing), GSR (Global State Routing), and OLSR (Optimized Link State Routing) have a fixed upper bound on route discovery time and function independently of traffic patterns, they have the important advantage of predictable performance. Reduced overhead by only creating routes in response to source node requests; however, the route discovery process may cause increased latency.

Predictable performance is a significant benefit of proactive protocols such as DSDV (Destination-Sequenced Distance-Vector Routing), GSR (Global State Routing), and OLSR (Optimized Link State Routing), which operate independently of traffic patterns and have a fixed upper bound on route discovery time.

VI. REACTIVE PROTOCOLS

On demand routing protocol is another name for reactive routing protocol. Anytime a route is required, it is found in this protocol. On demand, nodes start the route discovery process. The source node checks its route cache to verify if there is a route from the source

to the destination; if not, it starts the route discovery process. Route discovery and route maintenance are the two fundamental parts of on-demand routing technologies. Because routes are determined on demand, this protocol has a smaller overhead. It is not necessary to continuously update route databases with the most recent route topology in the on-demand idea. On demand routing uses the route discovery method, which involves flooding the network with route request (RREQ) packets. Ad hoc on-demand distance vector routing (AODV) and dynamic source routing (DSR) are two instances of reactive routing systems.

6.1 DSR (Dynamic source routing)

One of the drawbacks of the standard IETF-standardized DSR protocol prototype is that it relies solely on the minimum hop count parameter to choose the path, ignoring other variables that impact the performance of the routing algorithm, such as energy consumption, residual energy, and link stabilities. Moreover, DSR offers a low packet delivery ratio in high mobility contexts, lengthy delays, large routing overhead information, and extremely high energy consumption because of its ineffective route discovery technique, which is based on flooding. Therefore, by using a novel hybrid optimization strategy based on merging the MFO algorithm and the MET scheduling method, this study work seeks to improve the performance of the standard. While the MFO will decrease the average energy expenditure, the hybridization (MET-MFODSR) uses MET to boost throughput and packet delivery ratio while lowering the average end-to-end delay.

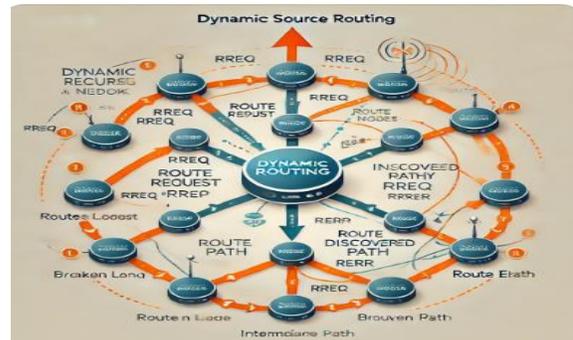


Fig 2: DSR

6.2 TORA (Temporally Ordered Routing Algorithm)

The distributed, adaptive algorithm known as TORA facilitates dynamic wireless networks. The TORA is the protocol for on-demand routing that offers

information on several routes. It falls into three primary categories: route construction, route maintenance, and route erasure. These include route generation, route maintenance, and route deletion. In extremely stressful situations, TORA may experience an unlimited worst-case convergence time. One special characteristic of TORA is that it maintains numerous routes to the goal, preventing any reaction to topological changes [4]. The target node is initially set to 0.

A message containing the destination node's ID and QRY packet is then broadcast by the originating node. A UDP packet will be returned if the sequence number is not 0. Nodes, in the meantime, received. An increased sequence number will be produced by UDP packets. It can create a DAG from source to destination in this manner. Also referred to as the link-reversal protocol, the TORA (Temporally-Ordered Routing Algorithm) is a hybrid routing protocol. It effectively addresses the current constraints in mobile ad hoc networks. Because of the high node mobility, congestion is a serious issue in MANETs. The shortest path algorithm, adaptive shortest path algorithm, and link state routing—all of which are conventional routing methods used for wired networks—cannot function correctly in mobile networks. Changing the routing tables of dynamic nodes is difficult. The TORA routing protocol. Every node sends out a query packet, receives one, and updates. It offers improved scalability and facilitates loop-free, multi-route services. It uses a set of always-ordered heights in addition to the Directed Acyclic Graph (DAG) to find a path. Information can only go in one direction with this mechanism. It involves four fundamental operations—route creation, maintenance, deletion, and optimization—and is therefore exclusively unidirectional, meaning there is no possibility of becoming stuck in an endless loop ([5], [6]).

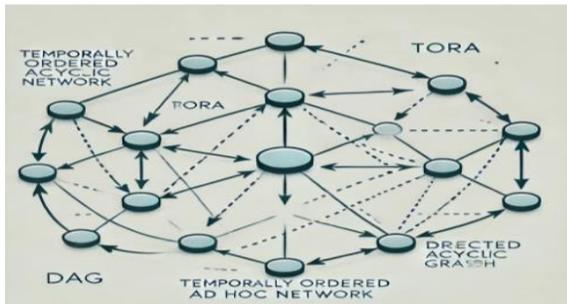


Fig 3: TORA Route Discovery

### 6.3 AODV ( Adhoc On Demand Distance Vector)

Local node motions have local impacts in AODV. In comparison to DSDV, it significantly lowers the control overhead and minimizes network-wide broadcasts. It finds routes using a route discovery cycle and bi-directional linkages. Sequence numbers and active routes are maintained in order to prevent loops. The unique characteristics of AODV are the route freshness criterion. It offers multicast in addition to unicast. communication. includes two main functions route discovery and route maintenance. Prior to route maintenance, it sends route requests (RREQ) to every node in the network in order to find the route. Source identity, destination identity, source sequence number, destination sequence number, time to live, and other information are all included in each RREQ. each time a node observes a shift in the local topology and adds a sequence number. The AODV routing protocol is susceptible to malevolent activity. A node behaves as a legitimate node when it transfers packets to the destination without any issues. A node begins acting maliciously during a malicious attack when it retains all packets internally and does not forward them to the destination node. The malicious nodes can easily disrupt the communication among nodes. It may launch DOS attack that is not part of route. AODV applies route formation by including various control messages that are route request (RREQ) and route reply (RREP). There is a limit to route requests that a particular node generates.

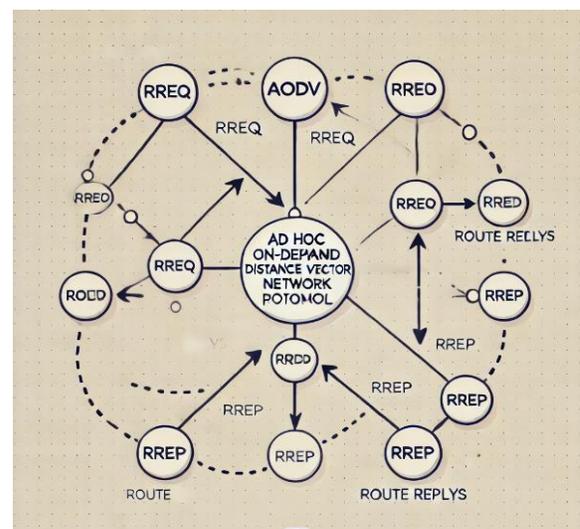


Fig 4: AODV Route Discovery

VII. HYBRID PROTOCOLS

Protocols that are only partially proactive or reactive function effectively in a constrained network environment. Hybrid routing protocols can also be combinations of proactive and reactive protocols, whereby far routes are set up reactively while proximate routes (e.g., no more than two hops) are kept up to date proactively. In these situations, both proactive and reactive routing techniques are ineffective. The benefits of proactive and reactive techniques are combined in hybrid routing protocols [7]. ZRP and ZHLS routing protocols are examples of hybrid protocols.

7.1 ZHLS

Routing protocols known as Zone-Based Hybrid Link-State Protocols (ZHLS) are typically utilized in network settings where performance and scalability are major considerations. These protocols are flexible enough to accommodate various network topologies and sizes because they integrate the advantages of both Link-State (LS) and Distance-Vector (DV) routing techniques. Zone-Based Hybrid Link-State Protocols primary idea is to partition a network into zones, each of which is handled differently according to its topology and size.

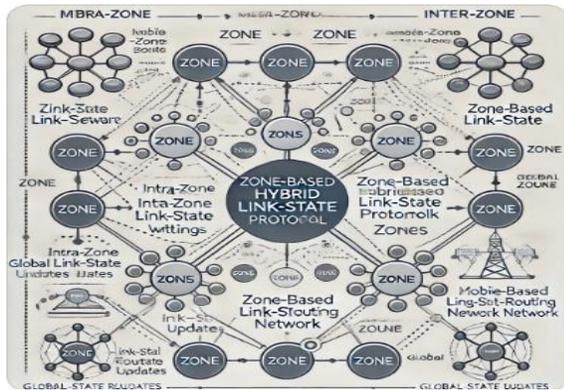


Fig 5: ZHLS

7.2 ZRP

The ZRP[8] is a hybrid reactive/proactive scheme. In ZRP, a node proactively maintains routes destinations within a local neighborhood, which is considered as a routing zone. A node routing zone is defined as a collection of nodes whose minimum distance hop from the node is no greater than a parameter referred to as the zone radius. Each node maintains its own routing

zone, but the routing zones of neighborhood nodes overlap. If a node wants to communicate with in its zone it can communicate proactively and the Intra zone Routing Protocol (IARP) is for routing outside of the routing zone, the Inter zone Routing Protocol (IERP) is utilized. ZRP employs the idea of border casting a node, whereby a node distributes packets to its periphery nodes of the routing zone if it is unable to locate its destination within a zone. The node is then in charge of proactively searching its own zone for the destination. Until the source reaches its destination, this process keeps on. The route request phase and the route reply phase are the two stages of the reactive routing process. Compared to a single proactive or reactive approach, ZRP performs better. However, this protocol can be enhanced to further increase its performance. Several improvements made to ZRP are presented in this publication.

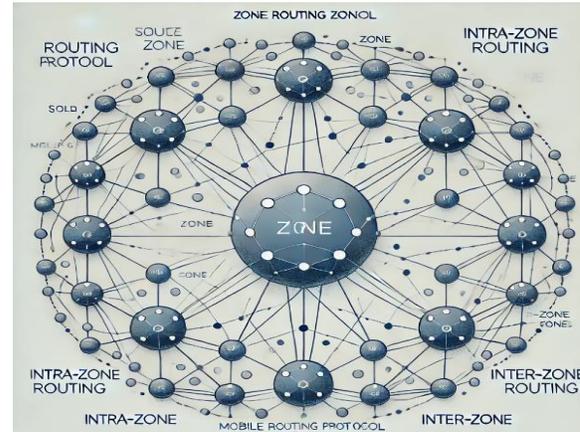


Fig 6: ZRP

7.3 SHARP

Proactive and reactive routing strategies can be switched between with ease and efficiency using the Sharp Hybrid Adaptive Routing Protocol. The network's measurable properties serve as the basis for this adaptation, which can be tailored to optimize for user-defined performance metrics like delay jitter, routing overhead, or loss rate. By dynamically altering the quantity of routing information shared proactively, SHARP transitions between reactive and proactive routing. By creating a proactive zone around a few nodes, it does this. The number of nodes in a given proactive zone is determined by a node-specific zone radius. Every node that is within the proactive zone for that node is one that is smaller than or equal to the zone radius. Reactive routing protocols are used by any nodes outside of a destination's proactive zone

to create paths leading to the node. Within a proactive zone, node-specific proactive routing is used. Only routes to the central node are proactively maintained by nodes in the proactive zone. Around popular locations that get data from a variety of sources, SHARP automatically establishes proactive zones. Once the packets reach any node in the zone periphery, the proactive zones serve as packet collectors and effectively transfer them to their destination.

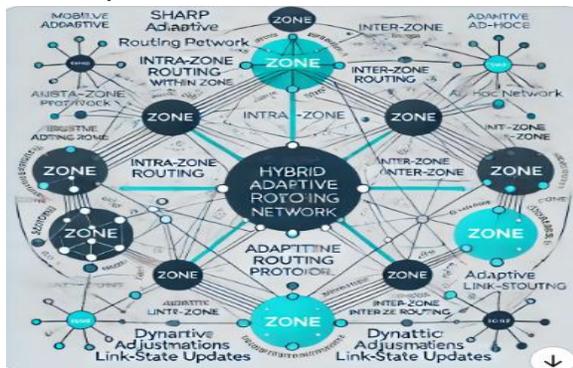


Fig 7: SHARP

### VIII. CONCLUSION

In this paper, we have presented the classification of wireless network, challenges in MANET, classification of routing protocols in mobile ad hoc networks. The protocols are divided into pro-active (table-driven), reactive (on-demand) and hybrid protocols. We have briefly discussed in reactive and hybrid routing protocols and its types. In future work it would be useful to understand the existing protocols available in reactive and hybrid protocols.

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